ACADEMIC CURRICULA

Professional Core Courses

AUTOMOBILE ENGINEERING

Regulations - 2018

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Kancheepuram, Tamil Nadu, India

Course Code	18AUC201J	Course Name	MANUFACTURING TECHNOLOGY FOR AUTOMOTIVE ENGINEERS	Course Category	C	*Professional Core*	L	T	P	C
							3	0	2	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Automobile Engineering*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Utilize knowledge of various manufacturing processes and machine tools and also familiarize the process parameters*			
CLR-2 :	*Utilize the work and tool holding devices*			
CLR-3 :	*Identify the various surface finishing process and coating techniques*			
CLR-4 :	*Produce Prismatic Components and Gears*			
CLR-5 :	*Compare various surface finishing operations*			
CLR-6 :	*Utilize different welding, casting processes, shaping, forming, machining and surface finishing processes*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1 :	*Apply different welding and casting process.*	*2*	*85*	*75*	*H*	*M*	*H*	*L*	*H*	*M*	*M*	*H*	*H*	*M*	*L*	*H*	*H*	*H*	*H*
CLO-2 :	*Compare various shaping and forming process*	*2*	*80*	*75*	*H*	*M*	*H*	*H*	*H*	*M*	*M*	*H*	*H*	*M*	*L*	*M*	*H*	*H*	*H*
CLO-3 :	*Solve problems on cutting forces, tool life and analytical methods of estimating cutting temperature*	*2*	*90*	*85*	*H*	*H*	*H*	*H*	*L*	*M*	*M*	*H*	*M*	*M*	*M*	*H*	*H*	*H*	*M*
CLO-4 :	*Produce Prismatic Components and Gears*	*2*	*85*	*80*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*H*
CLO-5 :	*Compare various surface finishing operations*	*2*	*80*	*75*	*H*	*M*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*H*
CLO-6 :	*Apply different welding, casting processes, shaping, forming, machining and surface finishing processes*	*2*	*85*	*75*	*H*	*M*	*H*	*L*	*H*	*M*	*M*	*H*	*H*	*M*	*L*	*H*	*H*	*H*	*H*

		Welding and Casting	Shaping and Forming	Machining of Axi-Symmetrical Components	*Machining of Prismatic Components and Gear Manufacturing*	*Surface Finishing and Treatments*
Duration (hour)		15	15	15	15	15
S-1	SLO-1	*Introduction to welding, Basics, Classifications*	*Forging - Introduction*	*Introduction - Machining*	*Introduction – Milling machine & types*	*Introduction – Finishing operations*
	SLO-2	*Material properties, material selection and Manufacturing process*	*Forging Processes and Defects*	*Theory of Metal Cutting*	*Milling cutters and work holding device*	*Grinding machine – Surface, Cylindrical – External, Internal, Centreless*
S-2	SLO-1	*Arc Welding – working principle and types*	*Rolling – Blooms, Billets, slabs*	*Mechanics of chip formation and types of chips*	*Milling operation and indexing*	*Grinding wheel types and specifications*
	SLO-2	*Working principles of MIG welding*	*Rolling – Billets, slabs*	*Calculation of cutting force and temperature in cutting.*	*Operating parameters- cutting speed, feed rate, depth of cut.*	*Grinding Operating parameters – surface finish, accuracy attainable by various process*
S-3	SLO-1	*Working principles of TIG welding*	*Forces and Geometrical relationship in rolling*	*Cutting tool materials – Tool life calculation,*	*Material Removal rate, Accuracy, Surface roughness*	*Lapping – process - application*
	SLO-2	*Friction and Friction Stir Welding*	*Types of Rolling Mills*	*Cutting tool materials - Tool Wear*	*Drilling Machine – Types, Process Capabilities*	*Honing – process - applications*
S 4-5	SLO-1	*Lab 1: Facing, Turning and Step turning*	*Lab 3: External thread cutting*	*Lab 5: V block shaping*	*Lab 7: Milling – Spur Gear*	*Lab 9: Cylindrical Grinding*
	SLO-2					
S-6	SLO-1	*Welding defects*	*Rolling Defects*	*Tool signature for single point cutting tool*	*Drill types and reaming operations*	*Buffing – process - applications*

	SLO-2	*Casting introduction, Pattern Materials, Types, allowance*	*Extrusion process – types*	*Tool signature for multi-point cutting tool.*	*Broaching- Principle, Tool Nomenclature*	*Deburring – Shot blasting*
S-7	SLO-1	*Expandable mold- sand,*	*Extrusion process – defects*	*Lathe machine – Bench Lathe*	*Types of Broaching machine*	*Deburring –Abrasive flow machining*
	SLO-2	*Expandable mold- shell*	*Wire and tube drawing – types and its defects*	*Lathe machine – Capstan and turrent*	*Gear Forming process-Extrusion, Stamping*	*Shot peening process and its application*
S-8	SLO-1	*Expandable mold-Investment*	*Drawing force Calculation*	*Lathe machine – Special types of lathe*	*Gear Manufacturing Process - Powder Metallurgy*	*Super finishing process- cylindrical micro honing*
	SLO-2	*Permanent mold – Pressure die casting, Centrifugal casting*	*Sheet metal operations – shearing, slitting,*	*Specification and chip collection system*	*Gear Hobbing - Axial*	*Super finishing process- centreless micro honing*
S 9-10	SLO-1	*Lab 2: Taper Turning*	*Lab 4: Radial Drilling*	*Lab 6: Gear Hobbing – Helical Gear*	*Lab 8: Surface Grinding*	*Lab 10: Slotting - keyway*
	SLO-2					
S-11	SLO-1	*Design of runner, riser,*	*Sheet metal operations - fine blanking, perforating*	*Cutting fluids and machinability*	*Gear Hobbing - Tangential*	*Polishing: Chemical Mechanical polishing*
	SLO-2	*Design of gating and sprue*	*Bending – types and defects*	*Work and tool holding devices*	*Gear Hobbing - Radial*	*Electro-chemical polishing*
S-12	SLO-1	*Solidifcation time, Shrinkage allowances*	*Bending Load calculations*	*Surface machining – external*	*Gear Hobbing – Application and its limitations*	*Protective and Decorative coatings – Material selection*
	SLO-2	*Casting Defects*	*Stretch forming, Deep drawing.*	*Surface machining – internal*	*Gear Shaping -Types and working principle*	*Protective and Decorative coatings – Process*
S-13	SLO-1	*Application of Casting in Automotive Industries.*	*Ironing, seaming process*	*Design consideration in turning operation*	*Gear Shaping-Advantages and Demerits*	*Protective and Decorative coatings – Coating techniques*
	SLO-2	*Application of Welding in Automotive Industries.*	*Hydroforming.*	*Material Removal rate and cutting forces*	*Tooling and selection of cutting parameters for gears.*	*Protective and Decorative coatings – Applications*
S 14-15	SLO-1	*Lab: Assessment 1*	*Lab: Assessment 2*	*Lab: Assessment 3*	*Lab: Repeat class*	*Lab: Mini Project*
	SLO-2					

Learning Resources	*1. Seropkalpakjian, Steven Schmid, Manufacturing Engineering and Technology, 7th ed., Pearson Education, 2013* *2. Mikel P Groover, Fundamentals of Modern Manufacturing, 4th ed., John Wiley and Sons, 2009*	*3. P N Rao, Manufacturing Technology – Machining and Machine tools, Vol. 2, 3rd ed., Tata Mc Graw Hill, 2017* *4. P N Rao, Manufacturing Technology – Foundry forming and Welding, Vol. 1, 4th ed., Tata Mc Graw Hill, 2013* *5. Sharma P C, A Text Book of Production Technology - Manufacturing Processes, S Chand & Company, New Delhi*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Silambarasan Ramadoss, Renault Nissan, silambarasan.ramadoss@rntbci.com	*1. Dr. A. Siddharthan, MIT Chrompet, sidharth@mitindia.edu*	*1. Dr. J. Chandradass, SRMIST*
2. Mr. N. Vijayakumar, Mahindra and Mahindra, vijayakumar.n@mahindra.com	*2. Dr. S. Renold Elson, VIT Vellore, renoldelsen.s@vit.ac.in*	*2. Mr. S. Palanisamy, SRMIST*

Course Code	18AUC204L	Course Name	AUTOMOTIVE COMPONENTS AND ASSEMBLY DRAWING	Course Category	C	*Professional Core*	L	T	P	C
							0	0	4	2

Pre-requisite Courses	*18MES101L*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Automobile Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Recognize simple projection and argumentation development of surface.*			
CLR-2 :	*Recognize the conventional representation of the standard automotive parts and make use of it in drawing the component*			
CLR-3 :	*Make use of appropriate standards in drawing the component*			
CLR-4 :	*Comprehend and apply the geometric dimensioning & tolerancing*			
CLR-5 :	*Analyze the functional requirement of Automotive parts and components*			
CLR-6 :	*Synthesis the Automotive components from the given part diagram*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Draw orthographic projection for simple 3D part diagrams*	*1*	*90*	*85*	*H*	*M*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*L*	*M*	*H*	*M*	*M*
CLO-2 :	*Represent the standard Automotive parts in conventional symbols and representations*	*1*	*90*	*85*	*M*	*H*	*L*	*M*	*M*	*L*	*L*	*L*	*M*	*L*	*L*	*H*	*H*	*M*	*H*
CLO-3 :	*List drawing standards*	*2*	*90*	*85*	*H*	*M*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*M*	*L*	*M*	*M*	*M*	*H*
CLO-4 :	*Apply the principle of geometric dimensioning & tolerancing in assembly drawing*	*3*	*85*	*80*	*M*	*M*	*L*	*H*	*M*	*L*	*L*	*L*	*M*	*M*	*L*	*H*	*M*	*M*	*H*
CLO-5 :	*Describe and draw the part drawings of Automotive component*	*3*	*85*	*80*	*M*	*M*	*L*	*H*	*M*	*L*	*M*	*L*	*M*	*M*	*L*	*M*	*H*	*L*	*M*
CLO-6 :	*Assemble and draw the part drawings into a finished Automotive component*	*3*	*85*	*80*	*M*	*M*	*H*	*M*	*H*	*L*	*M*	*L*	*M*	*M*	*L*	*M*	*H*	*L*	*H*

Duration (hour)		12	12	12	12	12
S 1-4	SLO-1	*Topic 1: Orthographic Projection, Development of surface & Section of solids*	*Topic 3: Abbreviations and symbols used in technical drawings. Symbols and method of indication on the drawing for surface finish, welding and riveted joints.*	*Topic 5: System of Fits -Hole Basis Systems (Quantitative approach for three types of fit)*	*Topic 7: Geometric tolerances – Form and positional. Datum and datum features symbols used to represent geometric tolerances. (Qualitative approach)*	*Topic 9: Jigs types-plate, latch, channel, box, post, pot jigs, automatic drill jigs.*
	SLO-2	*Drawing 1: ORTHOGRAPHIC PROJECTIONS*	*Drawing 3: ASSEMBLY OF SLEEVE & COTTER JOINT; FLANGE COUPLING*	*Drawing 5: ASSEMBLY OF SINGLE PLATE CLUTCH*	*Drawing 7: ASSEMBLY OF FUEL PUMP*	*Drawing 9: MAKE THE PART DIAGRAM OF PISTON CONNECTING ROD*
S 5-8	SLO-1	*Topic 2: BIS Code of Practice for Engineering Drawing: general principles of presentation, conventional representation of dimensioning (7 Types) and sectioning, threaded parts, gears, springs and common features.*	*Topic 4: Tolerance types and representation on the drawing – Fits types and selection for different applications, Limit System*	*Topic 6: System of Fits - Shaft Basis Systems (Quantitative approach for three types of fit).*	*Topic 8: Allowances for ferrous, non-ferrous & Non-metal- plastics/elastomers. Types- Casting & Machining allowances.*	*Topic 10: Fixture components- clamps, fixture base & set blocks, Types of fixtures- indexing milling fixture, turning fixture, welding fixture.*
	SLO-2	*Drawing 2: CONENTIONAL REPRESENTATION OF ENGG. PARTS AND DIMENSIONING.*	*Drawing 4: ASSEMBLY OF PLUMMER BLOCK*	*Drawing 6: ASSEMBLY OF FUEL INJECTOR*	*Drawing 8: MAKE THE PART DIAGRAM OF SPARK PLUG.*	*Drawing 10: MAKE THE PRODUCTION DRAWING OF A SIMPLE JIG & HELICAL GEAR*
S 9-12	SLO-1 SLO-2	*Lab: Assessment 1*	*Lab: Assessment 2*	*Lab: Assessment 3*	*Lab: Assessment 4*	*Lab: University Examination*

Learning Resources	*1. Narayana.K.L, Kanniah.P, Venkata Reddy.K, Machine Drawing, 5th ed., New Age International, 2016* *2. Gopalakrishnan.K.R, Machine Drawing, 20th ed., Subash Publishers, 2007* *3. Sidheswar N, Kannaiah.P, Sastry.V.V. S, Machine Drawing, Tata McGraw Hill, 2014*	*4. Bhatt N. D, Machine Drawing, 50th ed., Charotar publishing house pvt ltd, Anand, 2014* *5. Junnarkar N. D, Machine Drawing, 2nd ed.,Pearson Education (Singapore) Pvt. Ltd., 2009*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Understand										
Level 2	Apply	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*
	Analyze										
Level 3	Evaluate	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. N. Varatharaj, Comstar Automotive Technologies Pvt, Ltd, nvaratha@comstarauto.com	*1. Dr. P. Ramkumar, IIT Madras, ramkumar@iitm.ac.in*	*1. Dr. Rajendran R, SRMIST*
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Course Code	18AUC203T	Course Name	APPLIED THERMAL ENGINEERING FOR AUTOMOTIVE ENGINEERS	Course Category	C	*Professional Core*	L	T	P	C
							3	1	0	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Automobile Engineering*	Data Book / Codes/Standards		*Steam Table and Mollier chart*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Utilize the various gas power cycles*			
CLR-2 :	*Utilize knowledge in engine testing*			
CLR-3 :	*Utilize various heat transfer concepts*			
CLR-4 :	*Enlighten the knowledge in air compressors and refrigeration systems*			
CLR-5 :	*Construct knowledge on air conditioning systems*			
CLR-6 :	*Utilize knowledge on engines, heat transfer systems and air conditioning systems*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*To learn the basic assumptions, significance and efficiency of various air standard cycles*	*2*	*80*	*75*	*H*	*H*	*M*	*M*	*L*	*L*	*M*	*L*	*M*	*L*	*L*	*L*	*H*	*H*	*M*
CLO-2 :	*Acquire understanding and numerically applying the methods to determine engine performance parameters*	*3*	*80*	*75*	*H*	*H*	*M*	*M*	*M*	*L*	*M*	*L*	*M*	*L*	*L*	*M*	*H*	*H*	*M*
CLO-3 :	*Understand and apply basic heat transfer concepts in real world applications*	*3*	*80*	*75*	*H*	*H*	*M*	*M*	*M*	*L*	*M*	*L*	*M*	*L*	*L*	*M*	*H*	*H*	*H*
CLO-4 :	*Apply the knowledge in calculating the performance of air compressors and refrigerators*	*3*	*80*	*75*	*H*	*H*	*M*	*M*	*M*	*L*	*H*	*H*	*M*	*L*	*L*	*M*	*H*	*H*	*H*
CLO-5 :	*Calculate performance of air conditioning system using Psychrometric chart and applications in automotive climate control*	*3*	*80*	*75*	*H*	*H*	*M*	*M*	*M*	*L*	*M*	*M*	*M*	*L*	*L*	*M*	*H*	*H*	*H*
CLO-6 :	*Identify knowledge on engines, heat transfer systems and air conditioning systems*	*3*	*80*	*75*	*H*	*H*	*M*	*M*	*L*	*L*	*M*	*L*	*M*	*L*	*L*	*L*	*H*	*H*	*M*

		Air Standard cycle	Engine Performance Characteristics and Testing	Fundamentals of Heat Transfer Conduction	Air compressor and Refrigeration	Air Conditioning Processes and Application
Duration (hour)		12	12	12	12	12
S-1	SLO-1	*Introduction, Air standard cycles – Different air standard cycles*	*Introduction to performance parameters, Brake power, Frictional power*	*One-dimensional Heat Conduction Plane wall*	*Introduction of Air Compressor and its types*	*Properties of atmospheric air, Psychrometric chart, dry bulb temperature and wet bulb temperature*
	SLO-2	*Otto cycle significance, PV and TS diagram -processes*	*Indicated Power, Torque, Maximum brake torque*	*One-dimensional Heat Conduction Plane wall*	*Construction and Working of Single acting and double acting air compressors*	*Psychrometric Processes- Sensible heating and cooling*
S-2	SLO-1	*Otto Cycle- Brake thermal efficiency derivation*	*Fuel consumption Vs brake power, Specific fuel consumption*	*One-dimensional Heat Conduction Cylinder*	*Basics of Intercooler, Construction, Working - Multi stage Air Compressor*	*Psychrometric Processes - Humidification, Dehumidification,*
	SLO-2	*Compression ratio its effect on Brake thermal efficiency*	*Specific Energy consumption – definition, significance considering calorific values of different conventional fuels*	*One-dimensional Heat Conduction Cylinder*	*Compressor - work required –Isentropic, adiabatic and polytropic*	*Cooling and dehumidification Heating and Humidification*
S-3	SLO-1	*Otto Cycle- Mean Effective Pressure Mean Effective Pressure and work done*	*Volumetric efficiency, Ambient temperature, Mechanical efficiency*	*One-dimensional Heat Conduction Composite walls*	*Compressor - work required –Isentropic, adiabatic and polytropic*	*Bypass factor for heating and cooling coils*
	SLO-2	*Derivation for Mean effective pressure*	*Thermal efficiency – definition, heat input work done -significance*	*One-dimensional Heat Conduction Composite walls- Numericals*	*Work done without clearance volume*	*Bypass factor for heating and cooling coils*
S-4	SLO-1	*Tutorial 1: Otto Cycle -Determine brake thermal efficiency, compression ratio,*	*Tutorial 4: Brake power, frictional power, Indicated Power, specific fuel consumption*	*Tutorial 7: Plane walls, Cylinder and composite walls numericals*	*Tutorial 10: Work done with and without clearance - Problems*	*Tutorial 13: Psychrometric Processes*
	SLO-2					

		mean effective pressure				
S-5	SLO-1	*Diesel cycle Introduction to diesel cycle – significance*	*Engine specific weight, and heat balance Definition and significance*	*Heat transfer through extended surfaces (simple fins)*	*Free air delivery (FAD)*	*Summer Air conditioning system – construction and working*
	SLO-2	*PV and PV and TS diagram - processes*	*Heat balance – computation procedure, Shankey diagram*	*Critical thickness of insulation- Definition and significance*	*Rotary air compressors, -types and working*	*Summer Air conditioning system – construction and working*
S-6	SLO-1	*Diesel Cycle- Derive Brake thermal efficiency*	*Measurement of friction power - Different Methods*	*Convection: Types, Rate equation, Heat transfer coefficient*	*Fundamentals of refrigeration, COP,*	*Winter Air conditioning system – Construction and working*
	SLO-2	*Compression ratio, cut off ratio - its effect on Brake thermal efficiency*	*Measurement of friction power - Different Methods*	*Classes of convective flows, Introduction to dimensionless groups*	*Reversed Carnot cycle – PV, TS*	*Air conditioning - year-round air conditioning system*
S-7	SLO-1	*Diesel Cycle- Mean Effective Pressure, Mean Effective Pressure and work done*	*Measurement of different engine Performance Parameters*	*Introduction to hydrodynamic boundary layer*	*Simple vapour compression refrigeration system*	*Cooling load calculations*
	SLO-2	*Derivation for Mean effective pressure*	*Measurement of different engine Performance Parameters*	*Introduction to thermal boundary*	*PV-TS diagram analysis and COP*	*Cooling load calculations*
S-8	SLO-1	*Tutorial 2: Diesel cycle - Determine brake thermal efficiency, compression ratio, mean effective pressure*	*Tutorial 5: Brake thermal efficiency, volumetric efficiency, mechanical efficiency*	*Tutorial 8: Simple numerical's on heat transfer coefficient and heat transfer rate*	*Tutorial 11: Volumetric efficiency – Problems, FAD- Air compressor*	*Tutorial 14: Summer Air conditioning - Numericals*
	SLO-2					
S-9	SLO-1	*Dual cycle: Introduction to Dual cycle – significance*	*Fuel consumption, Air induction*	*Heat transfer in internal and external flow- Basics and examples*	*Simple vapour absorption refrigeration system –construction and working*	*Application of Air conditioning systems in automobiles*
	SLO-2	*PV and TS diagram -processes*	*Ambient temperature, exhaust temperature*	*Heat Exchangers: Types of heat Exchangers*	*Source of heat input, Determination of COP*	*Study of Automotive air conditioning systems*
S-10	SLO-1	*Dual Cycle- Brake thermal efficiency derivation*	*Introduction to manifold pressure and in-cylinder pressure measurement*	*LMTD method and NTU - concept*	*Desirable properties of an ideal refrigerants*	*Automotive climate control – climate governing factors*
	SLO-2	*Compression ratio, cut off ratio - its effect on Brake thermal efficiency*	*Case study: Engine testing facility requirements*	*Heat Exchangers: Effectiveness - Overall Heat Transfer Coefficient*	*Different Types of Refrigerants*	*Climatic control and its governing factors.*
S-11	SLO-1	*Dual Cycle - Mean Effective Pressure, Mean Effective Pressure and work done*	*Case study on Engine testing facility requirements*	*Fouling Factor, A real time case study on radiator*	*Methods to improve efficiency of vapour compression refrigeration. Eg: Avoiding two phase entry into compressor*	*Considerations for energy efficient heat exchange*
	SLO-2	*Derivation for Mean effective pressure*	*Case study: Real-time Engine parameters measurement, Eg: Ambient air conditioning fuel temperature compensation etc.*	*A real-time case study on radiator*	*Methods to improve efficiency of vapour absorption refrigeration or problems to be avoided*	*Considerations for energy efficient heat exchange*
S-12	SLO-1	*Tutorial 3: Dual cycle - Determine brake thermal efficiency, compression ratio, mean effective pressure*	*Tutorial 6: Numerical related to heat balance*	*Tutorial 9: Heat Exchangers: LMTD and NTU- Numericals*	*Tutorial 12: Vapour compression refrigeration Cycles – COP - Problems*	*Tutorial 15: Summer Air conditioning - Numericals*
	SLO-2					

Learning Resources	1. *R. Rudramoorthy, Thermal Engineering, 4th ed., Tata McGraw-Hill, 2007* 2. *Michael A. Boles, Yungus A. Cengel Thermodynamics: An Engineering Approach, 2nd ed., Tata McGraw-Hill, 2011* 3. *Yunus A Cengel, Afshin J. Ghajar, Heat and Mass Transfer: Fundamentals and Applications, 5th ed., Tata McGraw-Hill, 2015* 4. *C.P. Kothandaraman, Fundamentals of Heat And Mass Transfer, 4th ed., New Age International Publishers, 2012*	5. *R. K. Rajput, Thermal Engineering, 10th ed., Laxmi Publications(P)Ltd., 2015* 6. *https://www.edn.com/Pdf/ViewPdf?contentItemId=4403883* 7. *http://www.gbv.de/dms/ilmenau/toc/54857491X.PDF* 8. *https://www.airah.org.au/Content_Files/HVACRNation/2017/05-17-HVAC-001.pdf*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Gunabalan, Manager, R&D Turbo Energy, Chennai,	*1. Dr. Chandramohan, NIT Warangal,*	*1. Dr. C. Prabhu, SRMIST*
2. Mr. Shantha Kumar, Lead Engineer, Royal Enfield,	*2. Dr. Ganesh, Anna University, Chennai*	*2. Dr. S. Thiyagarajan, SRMIST*

ACADEMIC CURRICULA

Professional Core Courses

AUTOMOBILE ENGINEERING

Regulations - 2018

SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Kancheepuram, Tamil Nadu, India

Course Code	18AUC301J	Course Name	AUTOMOTIVE ENGINES	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	*18AUC203T*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Automobile Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-1 :	*Understand various components of the engine and its functions*																		
CLR-2 :	*Understand the combustion in SI Engine*																		
CLR-3 :	*Gain knowledge on combustion in CI Engine*																		
CLR-4 :	*Understand the lubrication, cooling system and able to test the lubricants and fuels used for IC engines*																		
CLR-5 :	*Understand the turbo, supercharging and scavenging system in IC Engines*																		
CLR-6 :	*Obtain the knowledge of test engines and can conduct the performance and heat balance test on IC engines using various dynamometers*																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*Understand the importance of valve timing diagram and firing order*	*1*	*90*	*85*	*H*	*M*	*H*	*M*	*M*	*L*	*M*	*L*	*L*	*L*	*L*	*M*	*M*	*L*	*M*
CLO-2 :	*Understand the combustion phenomena in SI Engines*	*1*	*90*	*85*	*H*	*L*	*L*	*M*	*L*	*L*	*H*	*L*	*L*	*L*	*L*	*H*	*H*	*L*	*M*
CLO-3 :	*Understand the combustion phenomena in CI Engines*	*1*	*90*	*85*	*H*	*L*	*L*	*M*	*L*	*L*	*H*	*L*	*L*	*L*	*L*	*H*	*H*	*L*	*M*
CLO-4 :	*Understand the lubrication and cooling system in IC Engines.*	*2*	*90*	*85*	*M*	*M*	*H*	*H*	*L*	*L*	*M*	*L*	*L*	*L*	*L*	*M*	*L*	*M*	*M*
CLO-5 :	*Understand the turbo, supercharging and scavenging system in IC Engines*	*2*	*90*	*85*	*H*	*M*	*M*	*L*	*M*	*L*	*M*	*L*	*L*	*L*	*L*	*M*	*M*	*M*	*M*
CLO-6 :	*Knowledge about the recent development in the area of engines*	*2*	*90*	*85*	*H*	*L*	*H*	*L*	*H*	*L*	*H*	*L*	*M*	*L*	*L*	*H*	*M*	*M*	*M*

Duration (hour)		15	15	15	15	15
S-1	SLO-1	*Introduction to engine components*	*Combustion in SI engines*	*Combustion in CI Engines*	*Introduction to Lubrication and Cooling system*	*Supercharging and Scavenging*
	SLO-2	*Constructional details of engine components, function,materials,*	*Stages of combustion, Flame propagation*	*Importance of air motion - Swirl, squish and turbulence*	*Need for cooling system - Types of cooling system*	*Objectives - Effects on engine performance*
S-2	SLO-1	*Valve timing diagram for SI and CI engine*	*Flame velocity and area of flame front*	*Swirl ratio. Fuel air mixing*	*Liquid cooled system*	*engine modification required*
	SLO-2	*Port timing diagram for SI and CI engine*	*Rate of pressure rise - Cycle to cycle variation*	*Stages of combustion*	*Thermosyphon system*	*Thermodynamics of supercharging*
S-3	SLO-1	*Firing order and its significance*	*Abnormal combustion - Theories of detonation*	*Delay period - Factors affecting delay period*	*Forced circulation system*	*Thermodynamics of Turbocharging*
	SLO-2	*Tutorial 1: Comparison of Valve Timing Diagrams for SI and CI engine*	*Tutorial 3: Comparison of SI and CI engine combustion process*	*Knocking in CI engines - methods of controlling diesel knock.*	*pressure cooling system*	*Turbo lag-Windage, losses*
S 4-5	SLO-1	*Lab 1: Valve Timing Diagram for Four Stroke Engine and port Timing Diagram for Two Stroke Engine*	*Lab 3: Performance test on Petrol engine at full throttle and part throttle conditions*	*Lab 5: Study of gasoline and diesel fuel supply system.*	*Lab 7: Test for optimum coolant flow rate in IC engines*	*Lab 9: Energy Balance test on an Automotive Diesel Engine*
	SLO-2					
S-6	SLO-1	*Intake system components - Discharge coefficient, Pressure drop*	*Introduction to Combustion chambers*	*CI engine combustion chamber.*	*Properties of coolant, additives for coolants*	*Turbo charging methods*

Duration (hour)		15	15	15	15	15
	SLO-2	*Air filter, intake manifold, Connecting Pipe*	*Effect of engine operating variables on combustion*	*Combustion chamber design objectives - open type*	*Need for lubrication system*	*Engine exhaust manifold arrangements.*
S-7	SLO-1	*Exhaust system components*	*Combustion chambers -types*	*Combustion chamber design objectives – divided type*	*Mist lubrication system*	*Classification of scavenging systems*
	SLO-2	*Exhaust manifold and exhaust pipe*	*factors controlling combustion chamber design*	*Induction swirl, turbulent combustion chambers*	*wet sump any dry sump lubrication*	*Mixture control through Reed valve*
S-8	SLO-1	*Spark arresters*	*Gasoline injection system*	*Air cell chamber - M Combustion chamber*	*Properties of lubricants, consumption of oil*	*Induction - Charging Processes in two-stroke cycle engine - Terminologies*
	SLO-2	*Exhaust mufflers, Types, operation*	*Tutorial 4: Combustion chamber designs*	*Diesel injection system*	*Tutorial 8: Lubrication methods*	*Shankey diagram - perfect displacement, perfect mixing.*
S 9-10	SLO-1	*Lab 2: Performance test on constant speed diesel engine*	*Lab 4: Morse test on petrol engines*	*Lab 6: Dismantling, measuring of components and Assembling of a multi cylinder engine.*	*Lab 8: Determination of viscosity of oil by different methods like, Redwood, Say bolt and Engler's Viscometer*	*Lab 10: Performance test on Diesel Engine at full load and part load conditions*
	SLO-2					

Learning Resources	
	1. *Ganesan V, "Internal combustion engines", 4th edition, Tata McGraw Hill Education, 2012.* 2. *Rajput R. K, "A textbook of Internal Combustion Engines", 2nd edition, Laxmi Publications (P) Ltd, 2007.* 3. *John. B, Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill Publishing Co., New York, 1900.*
	4. *Ramalingam K. K, "Internal Combustion Engines", Second Edition, Scitech Publications,2009* 5. *Mathur and Sharma, "A course on Internal combustion Engines", Dhanpat Rai & Sons, 1985.* 6. *Edward F, Obert, "Internal Combustion Engines and Air Pollution", Intext Education Publishers, 1980*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Jayaraman.R,BLG Logistics,jayaraman.r@blgparekh.com	*1. Dr.M.Parthasarathy, Vel Tech, nparthasarathy@veltech.edu.in*	*1. Dr. A. Prabu, SRMIST*
2. Mr. Shanmuga Sundaram , RNTBCI, sankaran@rntbci.com	*2. Dr.P.Nanthakumar, Amrita school of Engineering, p_nanthakumar@cb.amrita.edu*	*2. Dr. S. Thiyagarajan, SRMIST*

Course Code	18AUC302J	Course Name	VEHICULAR STRUCTURES AND DRIVELINE SYSTEMS	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Automobile Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Familiarize the structure of Vehicle frames, Front and Rear axles*			
CLR-2 :	*Acquire knowledge about various types of automotive driveline systems*			
CLR-3 :	*Explore the various components and functions of steering and suspension systems*			
CLR-4 :	*Understand the different types of automotive transmission systems*			
CLR-5 :	*Impart the knowledge of braking system, Wheels and tyres*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Demonstrate the basic structure of an automobile and various types of axles.*	*2*	*90*	*90*	*H*	*M*	*M*	*M*	*M*	*H*	*H*	*M*	*L*	*L*	*L*	*H*	*H*	*M*	*M*
CLO-2 :	*Identify the various types of automotive driveline systems.*	*2*	*90*	*90*	*H*	*M*	*M*	*M*	*M*	*H*	*H*	*M*	*L*	*L*	*L*	*H*	*H*	*M*	*M*
CLO-3 :	*Classify the different types of steering and suspension systems.*	*2*	*90*	*90*	*H*	*H*	*M*	*M*	*M*	*H*	*H*	*M*	*L*	*L*	*L*	*H*	*H*	*M*	*M*
CLO-4 :	*Classify the different types of transmission systems.*	*3*	*90*	*90*	*H*	*H*	*M*	*M*	*M*	*H*	*H*	*M*	*L*	*L*	*L*	*H*	*H*	*M*	*M*
CLO-5 :	*Identify the various types of braking systems, wheels and tyres.*	*2*	*90*	*90*	*H*	*M*	*M*	*M*	*M*	*H*	*H*	*M*	*L*	*L*	*L*	*H*	*H*	*M*	*M*

Duration (hour)		Frames, Front and Rear Axles	Drive Line and Final Drives	Steering and Suspension Systems	Transmission System	Brakes, Wheels and Tyres
		15	15	15	15	15
S-1	SLO-1	*Different types of chassis layout- FF, FR,RR and 4WD.*	*Effect of driving thrust and torque reactions.*	*Front wheel geometry - Caster, Camber.*	*Types of clutches, construction and working of single plate.*	*Theory of braking.*
	SLO-2	*Different types of chassis layout- FF, FR,RR and 4WD.*	*Effect of driving thrust and torque reactions.*	*Front wheel geometry - Toe in and toe out, SAI.*	*Multi plate and centrifugal clutch.*	*Stopping distance - Braking efficiency , Numerical analysis.*
S-2	SLO-1	*Types of vehicle body and Classifications.*	*Hotchkiss and torque tube drive.*	*Steering systems - True rolling motion of wheels and Numerical Analysis.*	*Torque capacity of clutch – Numerical Analysis.*	*Drum brakes - Single cam, Double cam.*
	SLO-2	*Types of vehicle body and Classifications.*	*Front wheel drive.*	*Simple problems*	*Simple problems*	*Leading and Trailing shoe types.*
S-3	SLO-1	*Frames- construction, Materials, LoadsActing on frames.*	*Propeller shaft –Construction, Critical Speed.*	*Ackermann and Davis steering Mechanism.*	*Fluid coupling – Construction*	*Disc brakes - Fixed, floating and radial mounted calipers.*
	SLO-2	*Frames- construction, Materials, LoadsActing on frames.*	*Universal joint, Slip joint.*	*Constructional details of steering linkages for rigid front axle.*	*Fluid coupling –Principle of operation.*	*Ventilated discs, cross drilled discs, slotted discs.*
S 4-5	SLO-1	*Lab 1: Study and measurement of various types of vehicle frame, body and driver seat.*	*Lab 4: Dismantling, study and assembling of automobile driveline and differential.*	*Lab 7: Dismantling, study and assembling of automobile suspension system.*	*Lab 10: Calculating the maximum torque carrying capacity of the given clutch using clutch dynamometer.*	*Lab 13: Dismantling, assembling and bleeding of a braking system.*
	SLO-2					
S-6	SLO-1	*Types of vehicle frames-Ladder frame, Tubular frame.*	*Constant velocity joints.*	*Constructional details of steering linkages for independent front axles.*	*Torque converters - Construction*	*Mechanical and hydraulic brake actuation.*
	SLO-2	*Integral frame, X-frame, Roll-cage frames.*	*Rzeppa and Tripod joints.*	*Steering gear box - Re-circulating ball type, Rack and pinion type, Worm and Nut type.*	*Principle of operation.*	*Pneumatic braking system.*

Duration (hour)		Frames, Front and Rear Axles	Drive Line and Final Drives	Steering and Suspension Systems	Transmission System	Brakes, Wheels and Tyres
		15	15	15	15	15
S-7	SLO-1	*Common vehicle platform- Need.*	*Different types of final drive - Worm and worm wheel, Straight bevel gear.*	*Power assisted steering - Hydraulic and EPS.*	*Hydro kinetic drives - Multistage torque converters.*	*Vacuum assisted hydraulic brakes.*
	SLO-2	*Common vehicle platform- merits and demerits.*	*Spiral bevel gear and hypoid gear final drives.*	*Four wheel Steering.*	*Poly-phase torque converters.*	*Air assisted hydraulic brakes.*
S-8	SLO-1	*Case study-Volkswagen PQ platform, Nissan B platform.*	*Double reduction final drive.*	*Need for suspension system. Types of suspension - Non independent suspension.*	*Types of gear boxes - Working of sliding and constant mesh gear boxes.*	*Need for ABS, ESP, EBD.*
	SLO-2	*Case study- Nissan B platform.*	*Twin speed final drive.*	*Independent suspension - McPherson and Wishbone suspension.*	*Construction and working of synchromesh gear box and principle of synchronizers*	*Need for Regenerative braking systems.*
S 9-10	SLO-1	*Lab 2: Study of different types of front and rear axles and final drives. Calculation of final drive ratio.*	*Lab 5: Dismantling, study and assembling of different automobile steering systems.*	*Lab 8: Dismantling, study and assembling of automobile clutches.*	*Lab 11: Dismantling, gear ratio calculation and assembling of an automobile transmission.*	*Lab 14: Study and analysis of the construction of various wheels and tyres.*
	SLO-2					
S-11	SLO-1	*Front axle – Live axles, Dead axles.*	*Differential- Principle.*	*Types of suspension springs - Leaf spring, Coil spring, Torsion bar, and Rubber springs.*	*Planetary gear box - construction and working.*	*Types of Wheels*
	SLO-2	*Front axle – Drop axles, Push and tag axles.*	*Differential- Construction details.*	*Shock absorbers.*	*Planetary gear box - construction and working.*	*Dimensions and Constructional details*
S-12	SLO-1	*Rear axles – Semi, full and three quarter floating.*	*Differential lock.*	*Pneumatic suspension systems.*	*Numerical in Gear box.*	*Types - Construction - Cross ply, Radialply,*
	SLO-2	*Housing types- Split Banjo and Salisbury type.*	*Differential lock.*	*Rear axle suspension system - Independent, Trailing Arm.*	*Automatic transmission - Chevrolet turbo glide - Construction and working..*	*Types - Construction - Tube and tubeless tyres.*
S-13	SLO-1	*Multi-link rear axles*	*Limited slip differential.*	*De-dion suspension and torsion beam.*	*Automatic transmission – Chevrolet Power glide - Construction and working..*	*Tyre designation.*
	SLO-2	*Multi-link rear axles*	*Limited slip differential.*	*Anti-roll bar, Pan hard rod and Radius rod*	*Hydraulic clutch actuation for Automatic transmission.*	*Tread patterns.*
S 14-15	SLO-1	*Lab 3: CLA-1*	*Lab 6: CLA-2*	*Lab 9: CLA-3*	*Lab 12: CLA-4*	*Lab 15: University practical examination.*
	SLO-2					

Learning Resources		
	1. *Kirpal Singh, "Automobile Engineering - Vol I", Standard Publishers Distributors, 1999.* 2. *Crouse W.H, Anglin D.L, "Automotive Transmission and Power Train construction", McGraw Hill, 1976.*	3. *Heldt P.M, "Torque converters", Chilton Book Co., 1992.* 4. *Newton Steeds &Garrot, "Motor Vehicles", SAE International and Butterworth Heinemann, 2001.*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. Mr.Franklin Darlie, HAL, franklindarlie@rediff.com	*2. Dr.R.Sakthivel, Sri Venkateswara College of Engineering, rsakthivel@svce.ac.in*	*2. Mr.Deepak M, SRMIST*

Course Code	18AUC303J	Course Name	AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEMS	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Automobile Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*To acquire knowledge of about the application of electrical and electronics in automotive systems*			
CLR-2 :	*Familiarize the usage of Sensors and actuators in Automobile*			
CLR-3 :	*Acquire the fundamental electronics applied vehicle motion control system*			
CLR-4 :	*Understanding the working of charging and lighting accessories in automobile*			
CLR-5 :	*Know about various Electrical equipment diagnostics and testing methods*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Understanding battery, Cranking motor construction and testing methods.*	*2*	*85*	*75*	*H*	*M*	*H*	*L*	*H*	*M*	*M*	*H*	*H*	*M*	*L*	*H*	*H*	*H*	*H*
CLO-2 :	*Understand the principle of alternator and to test the alternator*	*2*	*80*	*75*	*H*	*M*	*H*	*H*	*H*	*M*	*M*	*H*	*H*	*M*	*L*	*M*	*H*	*H*	*H*
CLO-3 :	*Apply the Electronic Controls in Gasoline Engine*	*2*	*90*	*85*	*H*	*H*	*H*	*H*	*L*	*M*	*M*	*H*	*M*	*M*	*M*	*H*	*H*	*H*	*M*
CLO-4 :	*Understand the basics of Vehicle Motion Control and telemetric system*	*2*	*85*	*80*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*H*
CLO-5 :	*Perform OBD II test on vehicle and Program hardware using Lab view*	*2*	*80*	*75*	*H*	*M*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*	*H*	*H*

Duration (hour)		Batteries and Starting Systems	Charging System and Lighting Auxiliaries	Electronic Engine Management System	Fundamentals of Vehicle Motion Control	Telematics and Vehicle Diagnostics
		15	15	15	15	15
S-1	SLO-1	*Unit – I Vehicle Batteries types*	*Unit- II Charging system - Introduction*	*Unit –III Introduction – Engine management system*	*Unit – IV Introduction – Vehicle motion control*	*Unit – V Introduction – Telematics*
	SLO-2	*Lead acid battery - Principle*	*Alternator Principle Construction, Working*	*Gasoline Engine Fuel Injector*	*Cruise Control System*	*GPS Navigation*
S-2	SLO-1	*Lead acid battery - Construction, Working*	*Alternator merits over D.C Generator*	*Single point Fuel Injections*	*Adaptive Cruise Control System - Construction*	*GPS Structure*
	SLO-2	*Battery Rating*	*Alternator Charging Circuits*	*Multi Point Fuel Injections*	*Adaptive Cruise Control System - Working*	*Dead Reckoning - Construction*
S-3	SLO-1	*Lead Acid battery Charging methods*	*Rectification of AC to DC*	*Merits of MPFI*	*Throttle Actuator Stepper Motor Based Control*	*Dead Reckoning - Working*
	SLO-2	*Testing Methods*	*Alternator Testing Methods*	*Testing of Fuel Injectors*	*Antilock Braking Mechanism - Construction*	*Inertial Navigation System - Construction*
S 4-5	SLO-1	*Lab 1: Battery Testing –Hydrometer, Load test, Individual Cell voltage test*	*Lab 3: Alternator Testing –Continuity test, Insulation Test, Load test.*	*Lab 5: Study of Lab view Programming*	*Lab 7: PWM Signal generation*	*Lab 9: UART communication for parking sensor*
	SLO-2					
S-6	SLO-1	*Fault Diagnosis.*	*Mechanical Voltage Regulator - Principle*	*Ignition system- Introduction*	*Antilock Braking Mechanism - Working*	*Inertial Navigation System - Working*
	SLO-2	*Requirement of a starting System*	*Mechanical Voltage Regulator – construction, working*	*Conventional Ignition System*	*Tire Slip Controller*	*Invehicle infotainment systems*
S-7	SLO-1	*Starter motor Construction*	*Electronic Voltage regulator –Principle*	*Electronic Ignition System*	*Merits of ABS*	*ADAS - Introduction*
	SLO-2	*Starter motor Working.*	*Electronic Voltage Regulator – construction, working*	*Programmed ignition system*	*Electronic Suspension System- Construction*	*ADAS features*

Duration (hour)		Batteries and Starting Systems	Charging System and Lighting Auxiliaries	Electronic Engine Management System	Fundamentals of Vehicle Motion Control	Telematics and Vehicle Diagnostics
		15	15	15	15	15
S-8	SLO-1	*Starter Drive Mechanism - introduction*	*Lighting Fundamentals*	*Distributor less Ignition System*	*Electronic Suspension System- Working*	*Electronic Control System Diagnostics,*
	SLO-2	*Starter Drive Mechanism - types*	*Lighting Circuit example*	*Waste spark analysis*	*Variable Damping*	*OBDII - Objective*
S 9-10	SLO-1	*Lab 2: Starter Motor –Continuity test, Insulation Test, Load test*	*Lab 4: Study of voltage regulator, solenoids*	*Lab 6: ADC interfacing for IR Sensor*	*Lab 8: H-Bridge Motor speed and position Control*	*Lab 10: Fault Diagnosis using OBD handheld Devices*
	SLO-2					
S-11	SLO-1	*Bendix drive*	*Conventional Headlamps – Sealed bulb headlamps*	*Digital Engine Control Modes*	*Variable Spring rate*	*Comparison of OBD I and OBD II*
	SLO-2	*Folo-thru drive*	*Conventional Headlamps – Bifilament headlamps*	*EGR Control*	*Merits of Electronic suspension system*	*Diagnostics Fault Codes*
S-12	SLO-1	*Over Running Clutch drive*	*LED Lighting System*	*variable valve timing*	*Electric Power Assisted Steering Mechanism- Construction*	*Introduction to Model-based Sensor Failure Detection*
	SLO-2	*Starter switch*	*Fog lamp*	*Ignition Controlling - Introduction*	*Electric Power Assisted Steering Mechanism- working*	*Model-based Sensor Failure Detection working*
S-13	SLO-1	*Starter Motor Fault Diagnosis*	*Wiper system*	*Closed loop ignition timing*	*Four Wheel Steering*	*Case Study on MAF Sensor calibration*
	SLO-2	*New Developments in Battery Technologies and Starting System*	*Signaling and Warning system*	*Spark Advance Correction Scheme*	*Steer-by-Wire*	*Case Study on MAF Sensor calibration .Cont*
S-14-15	SLO-1	*Lab: Assessment 1*	*Lab: Assessment 2*	*Lab: Assessment 3*	*Lab: Review class*	*Lab: Mini Project*
	SLO-2					

Learning Resources	
1. *Tom Denton "Automobile Electrical and Electronic Systems" 3rdedition, Elsiever Butterworth-Heinemann 2004.* 2. *William.B.Ribbens, "Understanding Automotive Electronics" 7th edition Butterworth-Heinemann publications, 2012.* 3. *Ed Doering "NI MYRIO Project Essential Guide" 2013,National Technology and Science Press*	4. *Allan.W.M.Bonnick "Automotive Computer Controlled System 2001,Butterworth-Heinemann* 5. *Robert Bosch Gmbh "Bosch Automotive Electric and Electronics" 5th edition Springer- 2007*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, and Conf. Paper etc.

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. *Mr.Jegan Amirthalingam, Senior Educator, KPIT a.jegan@kpit.com*	*1. Mr. Sam Jebakumar, SRM IST, jebakumj@srmist.edu.in*	*1. Mr. Joshua Paul E , SRMIST*
		2. Mr.Jesu Godwin D, SRMIST

Course Code	18AUC304J	Course Name	CAD ANALYSIS FOR AUTOMOTIVE ENGINEERS	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Automobile Engineering*	Data Book / Codes/Standards			

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Describe the various design concepts and modelling techniques*			
CLR-2 :	*Provide knowledge on computer graphics*			
CLR-3 :	*Introduce the latest developments in CAD Packages and GD&T*			
CLR-4 :	*Understand the FEM concepts*			
CLR-5 :	*Demonstrate the analysis tools*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*			
CLO-1 :	*Create the design models by various techniques*	*1*	*85*	*80*
CLO-2 :	*Develop the model using various features*	*2*	*80*	*75*
CLO-3 :	*Apply GD & T in design of automobile components*	*3*	*85*	*80*
CLO-4 :	*Solve the real world engineering problems using FEA.*	*2*	*80*	*75*
CLO-5 :	*Analyze the problems using FEA commercial packages.*	*3*	*85*	*80*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	*M*	*H*	*M*	*L*	*M*	*M*	*H*	*M*	*H*	*H*	*H*	*H*	*H*	*H*
H	*M*	*M*	*L*	*L*	*M*	*M*	*M*	*H*	*H*	*L*	*H*	*H*	*H*	*H*
H	*H*	*H*	*H*	*H*	*M*	*H*	*M*	*M*	*M*	*H*	*H*	*H*	*H*	*H*
H	*H*	*H*	*H*	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*H*
H	*H*	*H*	*H*	*H*	*M*	*M*	*M*	*H*	*M*	*M*	*H*	*H*	*H*	*H*

Duration (hour)		Introduction to CAD	Graphics Concepts (2D and 3D)	Software Packages and Recent Technology	FEM Fundamentals	Finite element Analysis
		15	15	15	15	15
S-1	SLO-1	*Introduction to CAD*	*Introduction to Coordinate system*	*Introduction to Software Packages*	*FEM Fundamentals - Introduction*	*Finite element Analysis - Introduction*
	SLO-2	*Product life cycle management*	*Model coordinate system,*	*Salient features of Software Packages*	*Degrees of freedom, h-convergence and p-convergence*	*Need for FEA in CAD Environment*
S-2	SLO-1	*Design models – pahl and beitz model*	*World coordinate system and Screen coordinate system*	*Technical comparison, Modules and tools*	*Need for Finite element method*	*Various stages of FEA - Preprocessing,*
	SLO-2	*Shigley model and Ohsuga model*	*Transformations in 2D and 3D*	*Need for data exchange standards and types*	*Nodes, element types*	*Solving and Post-processing*
S-3	SLO-1	*Geometric modelling – Introduction*	*Deriving transformation matrix for translation*	*Structure of STEP file system*	*Types of Constraints*	*Demonstration of the above using any one commercial packages*
	SLO-2	*Wireframe, surface and solid modelling*	*Deriving transformation matrix for scaling*	*Advantages and Disadvantages of STEP file system*	*Types of Boundary conditions*	*Structural analysis of beams and truss*
S 4-5	SLO-1	*LAB 1: Introduction to 2D sketch tool*	*LAB 3 : Introduction to various features for 3D Modelling*	*LAB 5 : 3D modelling of piston and connecting rod*	*LAB 7 : Exercises on Assembly of Knuckle joint*	*LAB 9 : Structural Analysis of trussand beams using ANSYS APDL*
	SLO-2					
S-6	SLO-1	*Constructive solid geometry*	*Deriving transformation matrix for Reflection*	*Structure of IGES file system*	*Steps in Finite element method*	*Introduction to modal analysis – Free Vibration*
	SLO-2	*Problems on Constructive solid geometry*	*Deriving transformation matrix for Rotation*	*Advantages and Disadvantages of IGES file system*	*Derivation of shape function*	*Forced Vibration*

Duration (hour)		Introduction to CAD	Graphics Concepts (2D and 3D)	Software Packages and Recent Technology	FEM Fundamentals	Finite element Analysis
		15	15	15	15	15
S-7	SLO-1	*Boundary representation*	*Problems on basic transformations*	*Brief outline of feature technology*	*Solution techniques – Point collocation method*	*Brief outline of kinematic analysis*
	SLO-2	*Problems on Boundary representation*	*Concatenated and Inverse transformation*	*Classification of features*	*Sub domain and Least square method*	*Steps in Kinematic analysis*
S-8	SLO-1	*Operations – Booleans and Extrude*	*Problems on Concatenated and Inverse transformation Visibility techniques – Minimax test*	*Design by features*	*Galerkin method*	*Modelling of Four bar mechanism*
	SLO-2	*Demonstration of boolean and extrude using Solidworks*		*Applications of feature based modelling*	*Derivation of stiffness matrix*	*Kinematic analysis of Four bar mechanism*
S 9-10	SLO-1	*LAB 2 : Exercises on 2D sketch*	*LAB 4 : Exercises on 3D Modelling*	*LAB 6: Exercises on Assembly of Screw jack*	*LAB 8 : Exercises on Assembly of Universal joint*	*LAB 10 : Finite element analysis on connecting rod using ANSYS Workbench*
	SLO-2					
S-11	SLO-1	*Sweep and Revolve*	*Containment test*	*Applying features to various automotive components*	*Tutorial on Finite element problems involving stepped bar*	*Modelling of Single slider mechanism*
	SLO-2	*Demonstration of sweep and revolve using Solidworks*	*Hidden line removal – priority algorithm*	*Advantages and limitations of feature based modelling*	*Interpretation of the results*	*Kinematic analysis of Single slider mechanism*
S-12	SLO-1	*Basic entities – Line*	*Light source and Shading – Constant shading models*	*Introduction to GD & T*	*Tutorial on Finite element problems involving triangular element.*	*Modelling of an automotive components - 1*
	SLO-2	*Circle*	*Gourand and Phong shading models*	*Need of GD&T*	*Interpretation of the results*	*Finite element analysis of an automotive components - 1*
S-13	SLO-1	*Ellipse and*	*Color models – RGB and CMYK model*	*Geometrical tolerance*	*Tutorial on Finite element problems involving springs.*	*Modelling of an automotive components - 2*
	SLO-2	*Parabola*	*Rendering and Animation*	*Dimensional tolerance*	*Interpretation of the results*	*Finite element analysis of an automotive components - 2*
S-14-15	SLO-1	*Lab Assessment 1*	*Lab: Repeat class*	*Lab Assessment 2*	*Lab Assessment 3*	*LAB 11 : Kinematic Analysis of 4-bar mechanism using ANSYS Workbench*
	SLO-2					

Learning Resources	
1. *Ibrahim Zeid, "CAD / CAM - Theory and Practice"., Tata Mcgraw-Hill, New Delhi, 2009*	4. *Newman and Sproull R. F., "Principles of interactive computer graphics", Tata Mcgraw-Hill, New Delhi, 2001*
2. *Radhakrishnan. P "CAD / CAM / CIM " New age international, 2018*	5. *Chandupatla and Belagundu, "Introduction to Finite Element Methods in Engineering", Prentice Hall of India Private Limited, New Delhi, 2002*
3. *Mikell P. Groover, "CAD / CAM"., Prentice Hall of India Private Limited, New Delhi, 2003*	

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember / Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply / Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate / Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.P. Nirmalkumar, Hubbell India, nirmal06kumar@gmail.com	*1. Dr.P.D.Jeyakumar, Crescent Institute of Science and Technology, pdjeyakumar@gmail.com*	*1. Dr. R.Rajendran, SRMIST, rajendrr@srmist.edu.in*
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Course Code	18AUC305T	Course Name	DESIGN OF AUTOMOTIVE COMPONENTS	Course Category	C	Professional Core	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Automobile Engineering*	Data Book / Codes/Standards		*Design Data, PSG College of Technology, 2012*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
CLR-1 :	*Understand the basic knowledge of automotive components respective to design*	Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-2 :	*Provide the idea of engineering materials selection*			
CLR-3 :	*Provide knowledge of basic valves design*			
CLR-4 :	*Provides the knowledge on forces of connecting rod*			
CLR-5 :	*Familiarize the design procedure of engine components*			

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*			
CLO-1 :	*Define the requirements and understand the automotive components*	*1*	*80*	*75*
CLO-2 :	*Select suitable materials for automobile components*	*2*	*85*	*80*
CLO-3 :	*Explain the procedure involved in design*	*3*	*85*	*80*
CLO-4 :	*Familiarize with various design standards*	*3*	*80*	*75*
CLO-5 :	*Design various automotive components to suit industrial needs.*	*3*	*85*	*80*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	*M*	*M*	*M*	*H*	*M*	*M*	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*
H	*H*	*H*	*M*	*L*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*H*	*H*
H	*H*	*H*	*H*	*L*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*H*	*H*
H	*H*	*H*	*H*	*L*	*M*	*M*	*M*	*M*	*M*	*H*	*H*	*H*	*H*	*H*
H	*H*	*H*	*H*	*L*	*M*	*M*	*M*	*H*	*M*	*H*	*H*	*H*	*H*	*H*

Duration (hour)		Design Of Shaft	Design of Cylinder And Piston	Design of Connecting Rod	Design of Crankshaft	Design of valves
		9	9	9	9	9
S-1	SLO-1	*Materials and Manufacturing of shaft*	*Introduction to Cylinder And Piston-*	*Introduction to Connecting Rod*	*Introduction to Crankshaft*	*Introduction to valves*
	SLO-2	*Materials and Manufacturing of shaft*	*Introduction to Cylinder And Piston-*	*Introduction to Connecting Rod*	*Introduction to Crankshaft*	*Introduction to valves*
S-2	SLO-1	*General Phases of design*	*Principal Parts of an IC Engine*	*Material selection for connecting rod*	*Introduction about crank shaft and its function in an I.C Engine.*	*Valve gear mechanism*
	SLO-2	*General Phases of design*	*Principal Parts of an IC Engine*	*Material selection for connecting rod*	*Introduction about crank shaft and its function in an I.C Engine.*	*Valve gear mechanism*
S-3	SLO-1	*Standard size of transmission shafts, stresses in shafts*	*Cylinder and Cylinder Liner*	*Forces Acting on the connecting rod*	*Materials selection for crankshaft*	*Types of valves*
	SLO-2	*Standard size of transmission shafts, stresses in shafts*	*Cylinder and Cylinder Liner*	*Forces Acting on the connecting rod*	*Materials selection for crankshaft*	*Types of valves*
S-4	SLO-1	*Shafts subjected to twisting moment only*	*Design of Bore,Length ,Thickness of cylinder head, studs size of the cylinder head*	*Dimensions of cross Section of the connecting rod*	*Bearing pressures and stresses in crankshaft*	*Design of size of valve port*
	SLO-2	*Shafts subjected to twisting moment only*	*Design of Bore,Length ,Thickness of cylinder head, studs size of the cylinder head*	*Dimensions of cross Section of the connecting rod*	*Bearing pressures and stresses in crankshaft*	*Design of size of valve port*
S-5	SLO-1	*Shafts Subjected to Bending Moment Only*	*Material for piston*	*Dimensions of cross Section of the connecting rod*	*Design Procedure for Crankshaft*	*Design of the valve disc*
	SLO-2	*Shafts Subjected to Bending Moment Only*	*Material for piston*	*Dimensions of cross Section of the connecting rod*	*Design Procedure for Crankshaft*	*Design of the valve disc*

Duration (hour)		Design Of Shaft	Design of Cylinder And Piston	Design of Connecting Rod	Design of Crankshaft	Design of valves
		9	9	9	9	9
S-6	SLO-1	*Shafts Subjected to combined Twisting Moment and Bending Moment*	*Design of critical parameters of piston design*	*Dimensions of the crank pin at the big end*	*Design of Centre Crankshaft When the crank is at dead centre*	*Design of maximum lift of the valve*
	SLO-2	*Shafts Subjected to combined Twisting Moment and Bending Moment*	*Design of critical parameters of piston design*	*Dimensions of the crank pin at the big end*	*Design of Centre Crankshaft When the crank is at dead centre*	*Design of maximum lift of the valve*
S-7	SLO-1	*Shafts Subjected to combined Twisting Moment and Bending Moment*	*Piston Rings*	*Dimensions of the piston pin at the small end*	*Design of Centre Crankshaft When the crank is at angle of maximum twisting moment*	*Design of valve stem diameter*
	SLO-2	*Shafts Subjected to combined Twisting Moment and Bending Moment*	*Piston Rings*	*Dimensions of the piston pin at the small end*	*Design of Centre Crankshaft When the crank is at angle of maximum twisting moment*	*Design of valve stem diameter*
S-8	SLO-1	*Shafts Subjected to Fluctuating loads*	*Piston Skirt*	*Size of bolts for securing the big end cap*	*Design of Overhung Crankshaft When the crank is at dead centre*	*Design of Pushrod*
	SLO-2	*Shafts Subjected to Fluctuating loads*	*Piston Skirt*	*Size of bolts for securing the big end cap*	*Design of Overhung Crankshaft When the crank is at dead centre*	*Design of Pushrod*
S-9	SLO-1	*Design of Shafts on the basis of Rigidity*	*Piston Pin*	*Thickness of the big end cap*	*Design of Overhung Crankshaft When the crank is at an angle of maximum twisting moment*	*Design of cross section of the push rod by rankine's formula*
	SLO-2	*Design of Shafts on the basis of Rigidity*	*Piston Pin*	*Thickness of the big end cap*	*Design of Overhung Crankshaft When the crank is at an angle of maximum twisting moment*	*Design of cross section of the push rod by rankine's formula*

Learning Resources	
1. *Kulkarni S. G, "Machine Design", Tata McGraw-Hill Education, 2008.*	3) *Khurmi, "A text book of Machine Desine", S Chand publication, 2016.*
2. *Bhandari V, "Design of Machine Elements",Tata McGraw-Hill Education, 2010.*	4) *Shigley J, "Mechanical Engineering Design", Tenth Edition,Mc Graw Hill, 2014.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember / Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply / Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate / Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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Course Code	18AUC401J	Course Name	VEHICLE DYNAMICS	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Automobile Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLR-1 :	*Learn about the sources, analysis and solution of problems pertaining to vehicular vibrations.*																		
CLR-2 :	*Learn about the sources and effects of dynamic forces acting on a vehicle system.*																		
CLR-3 :	*Acquire fundamental knowledge about ride comfort, vehicle stability issues and formulate fundamental mathematical relations for such issues to achieve a better design of automotive systems.*																		
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:																		
CLO-1 :	*Solve vibration problems with single degree of freedom*	*2*	*90*	*75*	*H*	*H*	*M*	*M*	*M*	*L*	*M*	*L*	*L*	*L*	*L*	*M*	*H*	*L*	*M*
CLO-2 :	*Interrelate the forces generated in the tire with tire slip phenomenon*	*2*	*80*	*80*	*H*	*M*	*M*	*L*	*H*	*L*	*M*	*L*	*L*	*L*	*L*	*M*	*H*	*L*	*M*
CLO-3 :	*Construct a mathematical model for vehicle suspension studies*	*3*	*85*	*80*	*H*	*H*	*H*	*H*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*M*	*H*	*L*	*M*
CLO-4 :	*Formulate the equation of motion of a vehicle in longitudinal direction*	*3*	*90*	*85*	*H*	*H*	*M*	*M*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*M*	*H*	*L*	*M*
CLO-5 :	*Predict the directional stability of vehicles based on driving conditions*	*2*	*85*	*80*	*H*	*H*	*M*	*M*	*H*	*M*	*M*	*M*	*L*	*L*	*L*	*M*	*H*	*L*	*M*

Duration (hour)		Basics of Vibration	Tires	Vertical Dynamics	Longitudinal dynamics	Lateral dynamics
		15	15	15	15	15
S-1	SLO-1	*Understand the Basic concepts of vibration*	*Define the co-ordinate system for an automotive vehicle and tire*	*List the methods for assessing human tolerance to vibration*	*List the resistive forces to longitudinal motion of vehicles*	*List the various side forces acting on a vehicle*
	SLO-2	*Classify the types of vibration*	*State the various forces and moments acting in an automotive tire*	*Describe the criteria for ride comfort*	*Explain the resistive forces to longitudinal motion of vehicles*	*Explain the effect of the side forces on the vehicle*
S-2	SLO-1	*Recall harmonic motion principles*	*List the various causes of rolling resistance of tires*	*Categorize the vertical dynamics modeling of vehicles*	*Apply Newton's law of motion for longitudinal dynamics of vehicles*	*Define steady state condition in lateral vehicle dynamics*
	SLO-2	*Explain the procedure for vibration analysis*	*State the expression for rolling resistance of tires*	*Evaluate the equation of motion for the vertical dynamic models*	*Calculate maximum tractive effort from the equation of motion for longitudinal dynamics*	*Judge the steady state handling characteristics of a vehicle based on the value of under steer co-efficient*
S-3	SLO-1	*Express and derive equation of motion for Free vibration of single degree of freedom – damped and undamped*	*Understand the phenomenon of tire slip*	*Design passive suspension system in quarter car model*	*Discuss the components in driveline*	*List the motion variables influenced by steering input*
	SLO-2	*Infer the amplitude decrement factor as logarithmic decrement*	*Recognize the generation of slip angle due to side forces*	*Analyze passive suspension system in quarter car model*	*Apply driveline dynamics in analyzing longitudinal dynamics equation*	*Analyze the influence of steering input on motion variables*
S 4-5	SLO-1	*Lab 1: Analysis of vibration system in Simulink\ Recall the fundamentals of vibration systems Analyze the vibration system in Simulink*	*Lab 4: Magic formula tire model State the magic formula tire model Represent the tire behavior using Magic formula*	*Lab 7: Half car model Recognize half car model of a vehicle Develop half car model in Simulink*	*Lab 10: Braking dynamics analysis using Car Maker Recall braking dynamics equation Analyze braking dynamics using Car Maker*	*Lab 13: Lateral dynamics analysis using Car Maker Recall lateral dynamics fundamentals Analyze lateral dynamics using Car Maker*
	SLO-2					

Duration (hour)		Basics of Vibration	Tires	Vertical Dynamics	Longitudinal dynamics	Lateral dynamics
		15	15	15	15	15
S-6	SLO-1	*Express and derive equation of motion for forced vibration of single degree of freedom – damped and undamped*	*Interpret the variation of longitudinal and lateral forces for various slip angles*	*Design semi active and active suspension systems in quarter car model*	*Calculate maximum acceleration for different drives*	*List the various tests to measure the handling characteristics of vehicles*
	SLO-2	*Apply the principle of base excitation to automotive vibration*	*Explain the concept of friction circle in tires*	*Analyze semi active and active suspension systems in quarter car model*	*Calculate reaction forces for different drives*	*Assess the handling characteristics of vehicles through various tests*
S-7	SLO-1	*Express and derive equation of motion for Free vibration of two degree of freedom – damped and undamped*	*Interrelate tractive effort with longitudinal slip of tires*	*Design passive suspension system in half car model*	*Derive an expression for load transfer while braking*	*Recognize the transient state conditions in the dynamic motion of vehicles*
	SLO-2	*Represent simple cases of automotive vibration as two degree of freedom system*	*Illustrate the relation between tractive effort and longitudinal slip of tires*	*Analyze passive suspension system in half car model*	*Derive an expression for load transfer while accelerating*	*Formulate the equation of motion in transient state*
S-8	SLO-1	*Examine automotive vibration problems as multi degree of freedom systems*	*Restate the generation of slip angle in tires*	*Design semi active and active suspension systems in half car model*	*Calculate the load distribution for three wheelers*	*Define the criteria for directional stability of vehicles*
	SLO-2	*Solve the multi degree of freedom system equation of motion for automotive vibrations*	*Diagram the cornering characteristics of tires*	*Analyze semi active and active suspension systems in half car model*	*Calculate the load distribution for four wheelers*	*Analyze the directional stability of vehicles through understeer co-efficient*
S 9-10	SLO-1	*Lab 2: Generation of road profile Identify the statistical method for road profile generation Create Simulink model for road profile generation*	*Lab 5: Quarter Car model Recognize quarter car model of a vehicle Develop quarter car model in Simulink*	*Lab 8: Shock absorber testing Recall the construction of a shock absorber Assess the shock absorber in a test rig*	*Lab 11: Active suspension study in Quanser test rig Recall active suspension concept Assess the active suspension test rig*	*Lab 14: Rollover analysis using Car Maker Recall vehicle roll over concept Analyze vehicle roll over using Car Maker*
	SLO-2					
S-11	SLO-1	*Understand modelling procedure*	*List the parameters for performance of tires on wet surfaces*	*Design passive suspension system in full car model*	*Predict the driving performance of vehicles from tractive effort value*	*Analyze the stability of a vehicle on a banked road*
	SLO-2	*Study the simulation of dynamic systems*	*Interpret the phenomenon of hydroplaning*	*Analyze passive suspension system in full car model*	*Analyze acceleration and braking performance of vehicles*	*Analyze the stability of a vehicle while taking turn*
S-12	SLO-1	*Show the variation of magnification factor with respect to frequency ratio*	*Demonstrate tire as a brush type model*	*Design semi active and active suspension systems in full car model*	*Diagram the ABS control loop*	*Understand the concept of roll center in vehicle dynamics*
	SLO-2	*Sketch the variation of vibrating system transmissibility with respect to frequency ratio*	*Demonstrate tire as a brush-string type model*	*Analyze semi active and active suspension systems in full car model*	*Illustrate the ABS control cycles with appropriate practical conditions*	*Understand the concept of roll axis in vehicle dynamics*
S-13	SLO-1	*Explain the principle of vibration absorbers*	*Model the tire empirically based on experimental data*	*Apply the PID control strategy to automotive suspension systems*	*Differentiate Traction Control System against ABS*	*Draw the single track model for a vehicle*
	SLO-2	*Classify the vibration measuring instruments*	*Present tire forces and moments as a function of slip phenomenon*	*Apply the skyhook and LQR control strategy to automotive suspension systems*	*Explain typical control situations for TCS action*	*Analyze the dynamics of a vehicle using single track model*
S 14-15	SLO-1	*Lab 3: Assessment 1*	*Lab 6: Assessment 2*	*Lab 9: Assessment 3*	*Lab 12: Repeat Class*	*Lab 15: University exam*
	SLO-2					

Learning Resources	1. *Mechanical Vibrations, Singiresu S Rao, 6th edition, 2017, Pearson Education, USA* 2. *Theory of Ground Vehicles, J.Y. Wong, 4th edition, John Wiley & Sons, New Jersey*	3. *Vehicle Dynamics and Control, Rajesh Rajamani, 2nd edition, 2012, Springer, New York* 4. *Simulink Manual/Documentation, Car Maker manual/ Documentation*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
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Course Code	18AUC402L	Course Name	VEHICLE TESTING LABORATORY	Course Category	C	Professional Core	L	T	P	C
							0	0	2	1

Pre-requisite Courses	*Nil*	Co-requisite Courses	Nil	Progressive Courses	*Nil*
Course Offering Department	*Automobile Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Demonstrate the purpose of chassis dynamometers in vehicle testing.*			
CLR-2 :	*Understand the procedures involved in HVAC testing and servicing.*			
CLR-3 :	*Analyze the various procedures involved in testing the steering and wheel geometry of an automobile.*			
CLR-4 :	*Study the procedures involved in measuring the tailpipe emissions of an automobile.*			
CLR-5 :	*Analyze the ignition pattern in an automobile.*			
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*			
CLO-1 :	*Conduct performance tests on automobiles using chassis dynamometers.*	*3*	*90*	*90*
CLO-2 :	*Perform tests and servicing on automobile HVAC using modern equipment.*	*3*	*90*	*90*
CLO-3 :	*Identify and adjust any deviations in steering and wheel geometry of an automobile using modern tools and equipment.*	*3*	*90*	*90*
CLO-4 :	*Perform tail pipe emission testing and analyze the deviations on emissions in an automobile.*	*3*	*90*	*90*
CLO-5 :	*Interpret the ignition pattern of an automobile to find out any ignition system malfunction.*	*3*	*90*	*90*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*L*	*H*	*H*	*M*	*H*
H	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*M*	*H*	*L*	*H*	*H*	*M*	*H*
H	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*H*	*H*	*L*	*H*	*H*	*M*	*H*
H	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*M*	*H*	*L*	*H*	*H*	*M*	*H*
H	*H*	*M*	*M*	*H*	*H*	*H*	*H*	*M*	*H*	*L*	*H*	*H*	*M*	*H*

Duration (hour)		6	6	6	6	6
S 1-2	SLO-1	*Lab 1: Studying the performance of a two wheeler using Eddy current chassis dynamometer.*	*Lab 4: CLA-1*	*Lab 7: Performing dynamic wheel balancing, tyre removal and fitment on the given LMV tyre.*	*Lab 10: Determination of caster, camber, toe-in and toe-out of the given HMV using computerized wheel alignment system.*	*Lab 13: Analyzing the tail pipe emissions and smoke density of the given automobile using 5-gas analyzer and smoke meter.*
	SLO-2					
S 3-4	SLO-1	*Lab 2: Studying the performance of a car using a four wheeler chassis dynamometer.*	*Lab 5: Determination of slide slip, suspension efficiency and brake efficiency using car test lane.*	*Lab 8: CLA-2*	*Lab 11: Performing dynamic wheel balancing, tyre removal and fitment on the given HMV tyre.*	*Lab 14: Study of secondary ignition pattern of an automobile using an oscilloscope analyzer.*
	SLO-2					
S 5-6	SLO-1	*Lab 3: Performing leak check and refrigerant refilling of the HVAC in an automobile.*	*Lab 6: Determination of caster, camber, toe-in and toe-out of the given LMV using 3D computerized wheel alignment system.*	*Lab 9: Performing headlight beam adjustment on the given automobile using computerized headlamp beam tester.*	*Lab 12: CLA-3*	*Lab 15: CLA-4*
	SLO-2					

Learning Resources	*1. Automotive Handbook- Robert Bosch GmbH, Wiley, 10th edition, 2018.*	*2. SPACE S.r.l. Instruction manual Code M0216 - rev.1.1 (11/2012)* *3. Bosch equipment instruction manuals.*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	-	*40%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
Level 2	Apply Analyze	-	*40%*	-	*40%*	-	*40%*	-	*40%*	-	*40%*
Level 3	Evaluate Create	-	*20%*	-	*30%*	-	*30%*	-	*30%*	-	*30%*
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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2. Mr. K.Suresh, HAL, sureshhal82@gmail.com.	*2. Dr.R.Ben Ruben, Sri Krishna College of Engineering, benrubenr@skcet.ac.in*	*2. Mr.Deepak M, SRMIST*

Course Code	18AUC350T	Course Name	COMPREHENSION	Course Category	C	Professional Core	L	T	P	C
							0	1	0	1

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Automobile Engineering*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLR-1 :	*Acquire skills to solve real world problems in Engineering Graphics Design, Engineering Mechanics and Mechanics of Solids*																		
CLR-2 :	*Acquire skills to solve real world problems in Machines and Mechanisms, Thermodynamics and Fluid Mechanics*																		
CLR-3 :	*Solve problems in Manufacturing Technology, Material Technology, Applied Thermal Engineering for Automotive Engineers*																		
CLR-4 :	*Solve problems in Automotive Engines, Vehicular Structures, Driveline Systems and Automotive Electrical and Electronics Systems*																		
CLR-5 :	*Acquire skills to solve real world problems in Design of Automotive components and CAD Analysis for Automotive Engineers*																		
CLR-6 :	*Acquire skills to solve real world problems for competitive examinations in Automobile and Mechanical Engineering*																		
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																		
CLO-1 :	*Practice and gain confidence, competence to solve problems in Engineering Graphics Design, Engineering Mechanics, Mechanics of Solids*	*3*	*85*	*80*	*H*	*H*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*M*	*L*	*M*
CLO-2 :	*Practice and gain confidence and competence to solve problems in Machines and Mechanisms, Thermodynamics and Fluid Mechanics*	*3*	*85*	*80*	*H*	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*M*	*M*	*M*
CLO-3 :	*Solve problems in Manufacturing Technology, Material Technology and Applied Thermal Engineering for Automotive Engineers*	*3*	*85*	*80*	*H*	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*M*	*L*	*M*
CLO-4 :	*Solve problems in Automotive Engines, Vehicular Structures and Driveline Systems and Automotive Electrical and Electronics Systems*	*3*	*85*	*80*	*H*	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*M*	*M*	*M*
CLO-5 :	*Practice and gain confidence,competence to solve problems in Design of Automotive components, CAD Analysis for Automotive Engineers*	*3*	*85*	*80*	*H*	*H*	*H*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*M*	*L*	*M*
CLO-6 :	*Practice and gain confidence and competence to solve problems in the broad domain of Automobile and Mechanical Engineering*	*3*	*85*	*80*	*H*	*H*	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*M*	*M*	*M*

Duration (hour)		3	3	3	3	3
S-1	SLO-1	*Tutorial on Engineering graphics and design*	*Tutorial on Machines and Mechanisms*	*Tutorial on Manufacturing Technology for Automotive Engineers*	*Tutorial on Automotive Engines*	*Tutorial on Design of Automotive components*
	SLO-2	*Problem Solving*	*Problem Solving*	*Problem Solving*	*Problem Solving*	*Problem Solving*
S-2	SLO-1	*Tutorial on Engineering Mechanics*	*Tutorial on Thermodynamics*	*Tutorial on Material Technology*	*Tutorial on Vehicular Structures and Driveline Systems*	*Tutorial on CAD Analysis for Automotive Engineers*
	SLO-2	*Problem Solving*	*Problem Solving*	*Problem Solving*	*Problem Solving*	*Problem Solving*
S-3	SLO-1	*Tutorial on Mechanics of Solids*	*Tutorial on Fluid mechanics*	*Tutorial on Applied Thermal Engineering for Automotive Engineers*	*Tutorial on Automotive Electrical and Electronics Systems*	*Problem Solving*
	SLO-2	*Problem Solving*	*Problem Solving*	*Problem Solving*	*Problem Solving*	*Problem Solving*

Learning Resources	1) *R.S.Khurmi, J.K.Gupta, Mechanical Engineering: Conventional and Objective Types, S.Chand& Co., 2018*	2) *R.K.Jain, Conventional & Objective Type Question & Answers on Mechanical Engineering for Competitions, Khanna Publishers, 2014*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination	
		CLA – 1 (20%)		CLA – 2 (30%)		CLA – 3 (30%)		CLA – 4 (20%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40%*	-	*30%*	-	*30%*	-	*30%*	-	-	-
	Understand										
Level 2	Apply	*40%*	-	*40%*	-	*40%*	-	*40%*	-	-	-
	Analyze										
Level 3	Evaluate	*20%*	-	*30%*	-	*30%*	-	*30%*	-	-	-
	Create										
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Jayaraman.R. BLG Logistics, jayaraman.r@bigparekh.com	*1. Dr. M.Parthasarathy, Vel Tech, nparthasarathy@veltech.edu.in*	*1. Dr. C.Prabhu, , SRMIST*
2. Mr. Shanmuga Sundaram, RNTBCI, sankaran@rntbci.com	*2. Dr.P.Nanthakumar, Amrita school of Engineering, p_nanthakumar@cb.amrita.edu*	*2. Dr. T.Prakash, SRMIST*